APPENDIX 6

CLOSE COUPLED CALCULATIONS

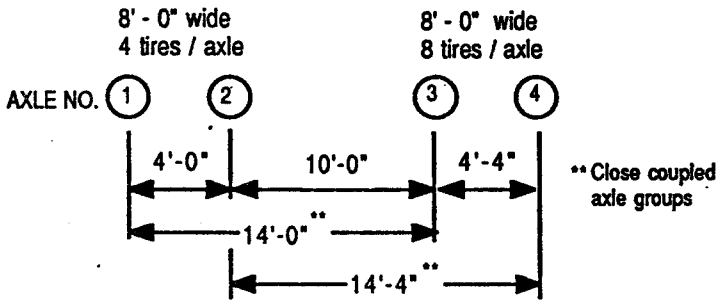
As noted in Chapter III "Close Coupling" exists when two axles of any group of axles are within 18'-0" of the closest axle of the adjacent group(s) of axles. Notice that balanced loading on all close coupled axles will provide max. gross weight , even when bonused equipment is used. Calculations shoud be run to determine that axle weights allowed meet close coupled axle group weights for both close coupled axle groups.

The folllowing pages illustrate "Close Coupling" situations including the axle weights for balanced loading and the max. axle group weight on either of the two groups. However , if the applicant provides specific axle group weights other than those shown, the same calculations may be used for the specific application.

"Bonus Factor " is the same percentage given to axle groups in the Standard Overload Charts. It is applied to each axle when calculating allowable axle group weights on close couped axle groups.

AXLE WIDTH	NO.OF TIRES /AXLE	BONUS FACTOR
8' - 0"	4	1.0 / AXLE
8' - 0"	8	1.15 / AXLE
10 - 0"	8	1.25 / AXLE

EXAMPLE :



In the above example axles 1 & 2 have a "Bonus Factor" of 1.0 for each axle. Axles 3 & 4 have a "Bonus Factor" of 1.15 for each axle. Therefore when calculating close coupled axle weights for axles 1,2 & 3 the following factors will apply:

AXLE 1 = Bonus Factor 1.0
AXLE 2 = Bonus Factor 1.0
AXLE 3 = Bonus Factor 1.15
Total 3.15

"Bonus Factor" for axle group 1,2 & 3 equals: 3.15 divided by 3 = 1.05

"Bonus Factor" for axle group 2,3 & 4 shows:

AXLE 2 = Bonus Factor 1.0
AXLE 3 = Bonus Factor 1.15
AXLE 4 = Bonus Factor 1.15
Total 3.30

"Bonus Factor" for axle group 2,3 & 4 equals: 3.30 divided by 3 = 1.1

Once the "Bonus Factor" for the axle group has been established the allowable weight for the axle group can be calculated. Non-bonused weights from the standard overload charts are always used when calculating axle group weights.

Allowable axle group weight for 1,2 & 3 equals:

Straight purple for 14'-0" ..... 56,700 lbs.
Bonus Factor for axles 1,2 & 3 = 1.05..... x 1.05
Max. allowable weight = 59,535 lbs.

CLOSE COUPLED CALCULATIONS

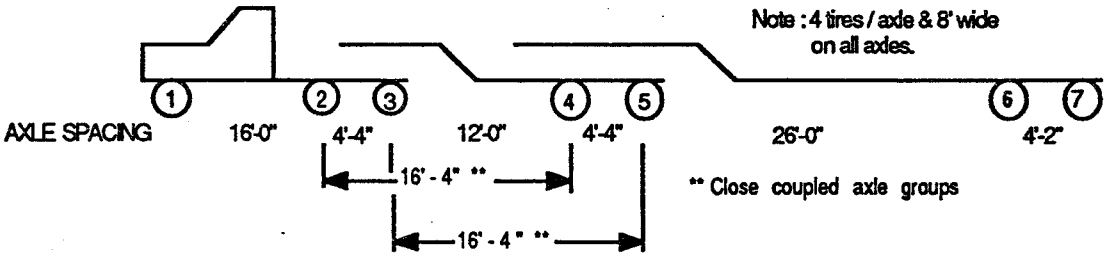
Allowable axle group weight for 2,3 & 4 equals: Straight purple for 14'-4" ..... 57,050 lbs.

Bonus Factor for axles 2,3 & 4 = 1.1 ..... x 1.1

Max. allowable weight = 62,755 lbs.

Similar calculations would be run for axle groups incorporating a 10'-0" wide axle with 8 tires / axle using the "Bonus Factor" of 1.25. Remember that straight purple(non-bonus) weight is always used in all close coupled calculations.

CLOSE COUPLED EXAMPLES



PURPLE CHART WEIGHT :

2 & 3 @ 4'-4" = 46,550 lbs. 2 3 4 @ 16'-4" = 59,150 lbs.

4 & 5 @ 4'-4" = 46,550 lbs. 3 4 5 @ 16,-4" = 59,150 lbs.

FOR BALANCED LOADING ON CLOSE COUPLED GROUPS

2,3 & 4 = 59,150 lbs. divided by 3 = 19,716 lbs. / axle

3,4 & 5 = 59,150 lbs. divided by 3 = 19,716 lbs. / axle

NOTE : **Balanced loading will prevail for max. gross weight .**

Therefore for balanced load distribution:

Axle 1	Axles 2&3	Axles 4&5	Axles 6&7
12,500	39,316	39,316	46,375

FOR MAX. ALLOWABLE WEIGHT ON AXLES 4 & 5

QUESTION: If max. allowable weight is authorized on axles 4 & 5 how much weight can be allowed on axles 2 & 3 before the axle weights exceed the max. close coupled weight allowed for axle groups 2,3 & 4 and 3,4 & 5?

Axle group 2,3 & 4 controlling would allow: axles 2 & 3 = 35,875 lbs.
axles 4 & 5 = 46,550 lbs.

Axle group 3,4 & 5 controlling would allow : axles 2 & 3 = 25,200 lbs.
axles 4 & 5 = 46,550 lbs.

Does either of the above axle weight examples exceed the close coupled allowables of 59,150 lbs. for axles 2,3 & 4 and axles 3,4 & 5?

Check for controlling group 2,3 & 4: Check No. 1 axles 2& 3 = 35,963 lbs. / axle no. 4 = 23,187 lbs. / axles 2,3 & 4 = 59,150 lbs. Check No. 2 axle no. 3 = 17,937 lbs. / axles 4 & 5 = 46,550 lbs. / axles 3,4 & 5 = 64,487 lbs.

This check shows that axle group 3,4 & 5 at 64,487 lbs. exceeds the max. allowable for that close coupled group 59,150 lbs.

Check for controlling group 3,4 & 5: Check No. 1 axles 2 & 3 = 25,200 lbs. / axle no. 4 = 23,275 lbs. / axles 2,3 & 4 =48,475 lbs. Check No. 2 axle no. 3 = 12,600 lbs. / axles 4 & 5 = 46,550 lbs. / axles 3,4 & 5 = 59,150 lbs.

This check shows that both close coupled axle groups are within the allowables. Therefore axle group 3,4 & 5 controls.

Therefore for max. loading on axles 4 & 5:

AXle 1	Axles 2 & 3	Axles 4 & 5	Axles 6 & 7
12,500	25,200	46,550	46,375

WEIGHT PENALTY

Equal loading on axles 2 & 3 and 4 & 5 ..... 2 x 39,316 lbs. = 78,632 lbs.

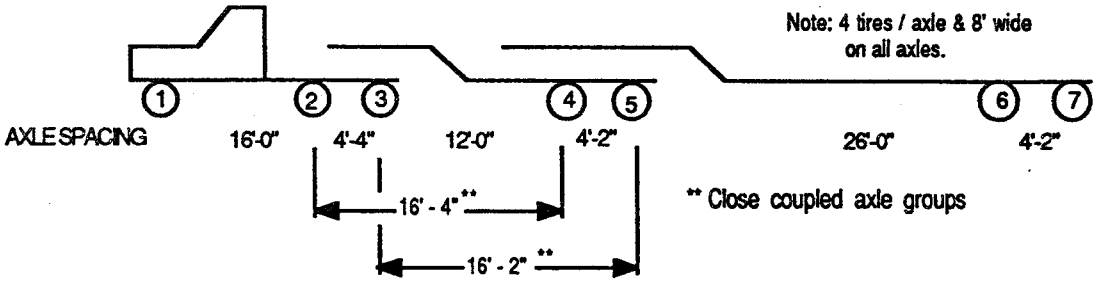
Max. loading axles 4 & 5 ..... 25,200 lbs. + 46,550 lbs. = 71,750 lbs.

Weight Penalty = 6,882 lbs.

Similar calculations would be run if max. weight on axles 2 & 3 were requested.

APPENDIX 6

CLOSE COUPLED CALCULATIONS



PURPLE CHART WEIGHT :

2 & 3 @ 4'-4" = 46,550 lbs. 2 3 4 @ 16'-4" = 59,150 lbs.

4 & 5 @ 4'-2" = 46,375 lbs. 3 4 5 @ 16,-2" = 58,975 lbs.

FOR BALANCED LOADING ON CLOSE COUPLED GROUPS

Axles 3,4 & 5 @ 16'-2" controls (lesser bridge)
16'-2" @ 58,975 lbs. divided by 3 = 19,658 lbs. / axle

NOTE : Balanced loading will prevail for max. gross weight .

Therefore for balanced load distribution:

Axle 1	Axles 2&3	Axles 4&5	Axles 6&7
12,500	39,316	39,316	46,375

FOR MAX. ALLOWABLE WEIGHT ON AXLES 4 & 5

QUESTION: If max. allowable weight is authorized on axles 4 & 5 how much weight can be allowed on axles 2 & 3 before the axle weights exceed the max. close coupled weight allowed for axle groups 2,3 & 4 and 3,4 & 5?

Axle group 2,3 & 4 controlling would allow: axles 2 & 3 = 35,963 lbs.
axles 4 & 5 = 46,375 lbs.

Axle group 3,4 & 5 controlling would allow : axles 2 & 3 = 25,200 lbs.
axles 4 & 5 = 46,375 lbs.

Does either of the above axle weight examples exceed the close coupled allowables of 59,150 lbs. for axles 2,3 & 4 or 58,975 lbs. for axles 3,4 & 5?

Check for controlling group 2,3 & 4: Check No. 1 axles 2& 3 = 35,963 lbs. / axle no. 4 = 23,187 lbs. / axles 2,3 & 4 = 59,150 lbs. Check No. 2 axle no. 3 = 17,981 lbs. / axles 4 & 5 = 46,375 lbs. / axles 3,4 & 5 = 64,356 lbs.

This check shows that axle group 3,4 & 5 at 64,356 lbs. exceeds the max. allowable for that close coupled group 58,975 lbs.

Check for controlling group 3,4 & 5: Check No. 1 axles 2 & 3 = 25,200 lbs. / axle no. 4 = 23,187 lbs. / axles 2,3 & 4 =48,387 lbs. Check No. 2 axle no. 3 = 12,600 lbs. / axles 4 & 5 = 46,375 lbs. / axles 3,4 & 5 = 58,975 lbs.

This check shows that both close coupled axle groups are within the allowables. Therefore axle group 3,4 & 5 controls.

Therefore for max. loading on axles 4 & 5:

AXle 1	Axles 2 & 3	Axles 4 & 5	Axles 6 & 7
12,500	25,200	46,375	46,375

WEIGHT PENALTY

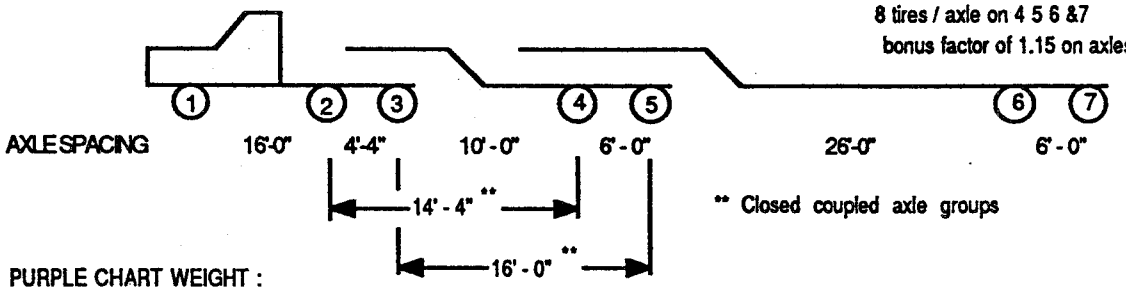
Equal loading on axles 2 & 3 and 4 & 5 ..... 2 x 39,316 lbs. = 78,632 lbs.
Max. loading axles 4 & 5 ..... 25,200 lbs. + 46,375 lbs. = 71,575 lbs.
Weight Penalty = 7,057 lbs.

Similar calculations would be run if max. weight on axles 2 & 3 were requested.

APPENDIX 6

CLOSE COUPLED CALCULATIONS

Note : 4 tires / axle on 2 & 3
8 tires / axle on 4 5 6 &7
bonus factor of 1.15 on axles 4 5 6 &7



** Closed coupled axle groups

PURPLE CHART WEIGHT :

2 & 3 @ 4'-4" = 46,550 lbs.
4 & 5 @ 6'-0" = 55,545 lbs.

2 , 3 & 4 @ 14'-4" = 57,050 lbs. x 1.05 = 59,902 lbs.
3 , 4 & 5 @ 16'-0" = 58,800 lbs. x 1.15 = 64,680 lbs.

FOR BALANCED LOADING ON CLOSE COUPLED GROUPS

2 ,3 & 4 @ 14'-4" = 59,902 lbs. controls (lesser weight)
59,902 lbs. divided by 3 = 19,967 lbs. / axle

NOTE : Balanced loading will prevail for max. gross weight .

Therefore for equal load distribution :

Axle 1	Axles 2 & 3	Axles 4 & 5	Axles 6 & 7
12,500	39,934	39,934	55,545

FOR MAX. ALLOWABLE WEIGHT ON AXLES 4 & 5

QUESTION: If max. allowable weight is authorized on axles 4 & 5 how much weight can be allowed on axles 2 & 3 before the axle weights exceed the max. close coupled weight allowed for axle groups 2,3 & 4 and 3,4 & 5?

Axle group 2,3 & 4 controlling would allow: axles 2 & 3 = 32,130 lbs.
axles 4 & 5 = 55,545 lbs.

Axle group 3,4 & 5 controlling would allow : axles 2 & 3 = 18,270 lbs.
axles 4 & 5 = 55,545 lbs.

Does either of the above axle weight examples exceed the close coupled allowables of 59,902 lbs. for axles 2,3 & 4 or 64,680 lbs. for axles 3,4 & 5?

Check for controlling group 2,3 & 4: Check No. 1 axles 2& 3 = 32,130 lbs. / axle no. 4 = 27,772 lbs. / axles 2,3 & 4 = 59,902 lbs.
Check No. 2 axle no. 3 = 16,065 lbs. / axles 4 & 5 = 55,545 lbs. / axles 3,4 & 5 = 71,610 lbs.

This check shows that axle group 3,4 & 5 at 71,610 lbs. exceeds the max. allowable for that close coupled group 64,680 lbs.

Check for controlling group 3,4 & 5: Check No. 1 axles 2 & 3 = 18,270 lbs. / axle no. 4 = 27,772 lbs. / axles 2,3 & 4 =46,042 lbs.
Check No. 2 axle no. 3 = 9,135 lbs. / axles 4 & 5 = 55,545 lbs. / axles 3,4 & 5 = 64,680 lbs.

This check shows that both close coupled axle groups are within the allowables. Therefore axle group 3,4 & 5 controls.

Therefore for max. loading on axles 4 & 5:

AXle 1	Axles 2 & 3	Axles 4 & 5	Axles 6 & 7
12,500	18,270	55,545	55,545

WEIGHT PENALTY

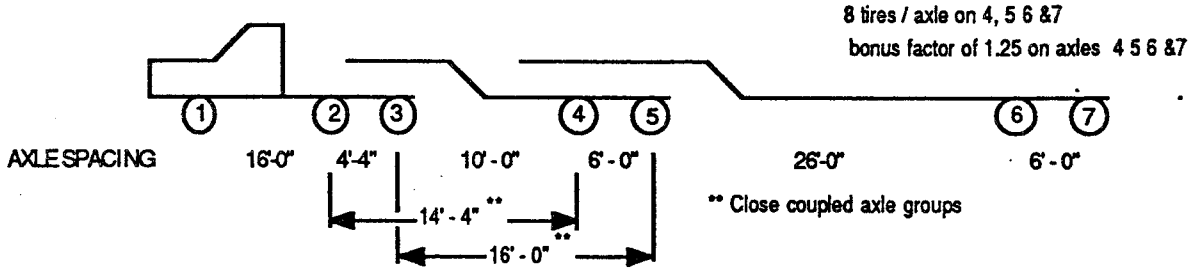
Equal loading on axles 2 & 3 and 4 & 5 ..... 2 x 39,934 lbs. = 79,868 lbs.
Max. loading axles 4 & 5 ..... 18,270 lbs. + 55,545 lbs. = 73,815 lbs.
Weight Penalty = 6,053 lbs.

Similar calculations would be run if max. weight on axles 2 & 3 were requested.

APPENDIX 6

CLOSE COUPLED CALCULATIONS

Note : 4 tires / axle on 2 & 3
8 tires / axle on 4, 5 6 &7
bonus factor of 1.25 on axles 4 5 6 &7



PURPLE CHART WEIGHT :

2 & 3 @ 4' - 4" = 46,550 lbs. 2 , 3 & 4 @ 14' - 4" = 57,050 lbs. x 1.08 = 61,614 lbs.
4 & 5 @ 6' - 0" = 60,000 lbs. 3 , 4 & 5 @ 16' - 0" = 58,800 lbs. x 1.17 = 68,796 lbs.

FOR EQUAL WEIGHT ON CLOSE COUPLED GROUPS

2 ,3 & 4 @ 14' - 4" = 61,614 lbs. controls (lesser weight) **NOTE : Balanced loading will prevail for max. gross weight .**
61,614 lbs. 3 = 20,538 lbs. / axle

Therefore for equal load distribution :

Axle 1	Axles 2 & 3	Axles 4 & 5	Axles 6 & 7
12,500	41,076	41,076	60,000

FOR MAX. ALLOWABLE WEIGHT ON AXLES 4 & 5

QUESTION: If max. allowable weight is authorized on axles 4 & 5 how much weight can be allowed on axles 2 & 3 before the axle weights exceed the max. close coupled weight allowed for axle groups 2,3 & 4 and 3,4 & 5?

Axle group 2,3 & 4 controlling would allow: axles 2 & 3 = 31,614 lbs.
axles 4 & 5 = 60,000 lbs.

Axle group 3,4 & 5 controlling would allow : axles 2 & 3 = 17,592 lbs.
axles 4 & 5 = 60,000 lbs.

Does either of the above axle weight examples exceed the close coupled allowables of 59,902 lbs. for axles 2,3 & 4 or 64,680 lbs. for axles 3,4 & 5?

Check for controlling group 2,3 & 4: Check No. 1 axles 2& 3 = 31,614 lbs.
axle no. 4 = 30,000 lbs.
axles 2,3 & 4 = 61,614 lbs.

Check No. 2 axle no. 3 = 15,807 lbs.
axles 4 & 5 = 60,000 lbs.
axles 3,4 & 5 = 75,807 lbs.

This check shows that axle group 3,4 & 5 at 75,807 lbs. exceeds the max. allowable for that close coupled group 68,796 lbs.

Check for controlling group 3,4 & 5: Check No. 1 axles 2 & 3 = 17,592 lbs.
axle no. 4 = 30,000 lbs.
axles 2,3 & 4 =47,592 lbs.

Check No. 2 axle no. 3 = 8,796 lbs.
axles 4 & 5 = 60,000 lbs.
axles 3,4 & 5 = 68,796 lbs.

This check shows that both close coupled axle groups are within the allowables. Therefore axle group 3,4 & 5 controls.

Therefore for max. loading on axles 4 & 5:

AXle 1	Axles 2 & 3	Axles 4 & 5	Axles 6 & 7
12,500	17,592	60,000	60,000

WEIGHT PENALTY

Equal loading on axles 2 & 3 and 4 & 5 ..... 2 x 41,076 lbs. = 82,152 lbs.
Max. loading axles 4 & 5 ..... 17,592 lbs. + 60,000 lbs. = 75,592 lbs.
Weight Penalty = 6,560 lbs.

Similar calculations would be run if max. weight on axles 2 & 3 were requested.